Assessment of Age and Growth in Rainbow Trout (*Oncorhynchus mykiss*) in Strongs Creek, Ogden Utah

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Introduction

Rainbow trout (*Oncorhyncus mykiss*) are one of the most widespread species of salmonids in the world and are frequently introduced as a game species in a variety of habitats (Crawford and Muir 2008). Given their popularity, much information is available concerning their ecology as an effort to better manage their populations. The age structure and growth rates of rainbow trout populations have been found to vary with regards to differing environmental factors (Arismendi et al. 2011). That being said, there is not much information available concerning the growth and age of rainbow trout populations in small mountainous creeks along Utah's Wasatch Front. With this in mind, we sought to assess age and growth within the rainbow trout population in Strongs Creek, Ogden, Utah. Strongs Creek (Figure 1) is a small first-order stream set in the Wasatch Mountains within the city of Ogden, Utah. A portion of this stream supports a sizable population of rainbow trout, and can be characterized by a high gradient, low velocity flows, and a relatively rocky substrate.

Figure 1. Map of Strongs Creek with individual sample sites labeled. Map of Utah in the top right corner highlights the county in which Strongs Creek is located.

Methods and Analyses

Rainbow trout were collected at three sites based upon elevation along Strongs Creek during the fall of 2011. The sites were 100 m in length, and elevations for the three sites were 1539 m, 1630 m, and 1737 m respectively. A fourth site located at 1831 m was also sampled, in which no fish were present. Fish were collected using a backpack electrofisher (Figure 2) and two passes were completed at each site.

Figure 2. Electrofishing in Strongs Creek during the fall of 2011.

Methods and Analyses Cont.

The total length of each fish, which is a measurement taken from the snout of the fish to the tip of the tail, was measured to the nearest millimeter. Six fish of various lengths were haphazardly selected to be aged. Scales were removed from the fish to be aged using standard procedures (Jearld 1983). Scales were then mounted between two microscope slides, and at least three scales were aged from each fish under a microscope by counting the number of annuli (Figure 3), which are formed by growth checks caused by lack of growth during winter. Aging was conducted conjointly between investigators, with any disagreements being resolved with the help of another party. In order to back calculate growth among cohorts, we followed a formula as described by Isely and Grabowski (2007):

$$L_i = \frac{L_c - a}{S_c} S_i + a$$

where L_i is the fish length at annulus formation, L_c is the fish length at capture, S_i is the radius at annulus formation, S_c is the overall scale radius, and α is the size of the individual at the time of scale formation. We determined the size of the individual at the time of scale formation (α) to be 42 mm based on a previous study on rainbow trout growth in Utah (Rabe 1967). We also calculated the average growth in the first year, second year, and third year (where possible) of rainbow trout at each of the three sites.

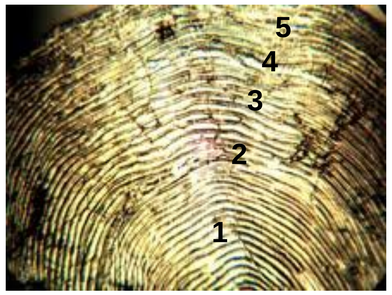

Figure 3. Picture of rainbow trout scale with annuli marked. Growth checks are formed when lines in the scale overlap.

Results

Individual ages of rainbow trout sampled ranged from 1 to 5 years old (mean = 3 years; SD = 1.1). Length of the fish sampled ranged from 45 mm to 265 mm (mean = 131 mm; SD = 29.7). The growth of rainbow trout in Strongs Creek was fairly similar among cohorts from year to year, throughout their lives, and amongst the three sites in all the fish sampled (Figures 4, 5, and 6). Average first-year growth of the fish sampled from the three sites was 79 mm (SD = 10.0) (Table 1). Following a rapid growth rate in the first year, rainbow trout growth subsequently declined but remained consistent. Average second-year growth of the fish sampled from the three sites was 26 mm (SD = 6.8) (Table 2), and average third-year growth of the fish sampled from the three sites was 29 mm (SD = 6.1) (Table 3). Overall, growth of rainbow trout within Strongs Creek appeared to be fairly stable within all fish sampled.

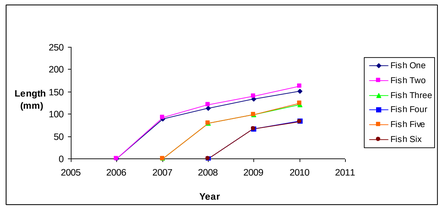

Figure 4. Graph of individual trout ages at 1539 m, along with back-calculated growth rates of each fish between successive years.

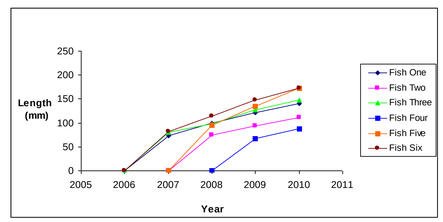

Figure 5. Graph of individual trout ages at 1630 m, along with back-calculated growth rates of each fish between successive years.

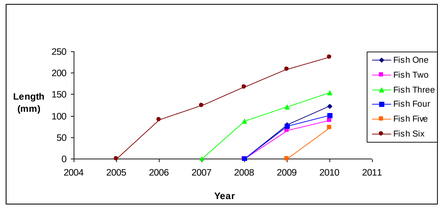

Figure 6. Graph of individual trout ages at 1737 m, along with back-calculated growth rates of each fish between successive years.

Table 1. First-year growth (mm) of rainbow trout in Strongs Creek, Utah.

Elevation (m)	1539	1630	1737
Fish one	88.76	73.71	79.99
Fish two	92.46	73.86	65.65
Fish three	79.04	80.88	88.33
Fish four	67.02	67.92	76.33
Fish five	80.17	94.94	72.46
Fish six	66.44	82.42	91.27
Average (Standard Deviation)	78.98 (10.76)	78.95 (9.45)	79.01 (9.66)

Table 2. Second-year growth (mm) of rainbow trout in Strongs Creek, Utah

Elevation (m)	1539	1630	1737
Fish one	24.34	25.63	42.22
Fish two	27.98	20.18	24.17
Fish three	98.26	17.75	33.02
Fish four	17.22	19.87	24.01
Fish five	18.41	39.38	
Fish Six	16.40	31.10	32.33
Average (Standard Deviation)	20.60 (4.57)	25.65 (8.30)	31.12 (7.54)

Table 3. Third-year growth (mm) of rainbow trout in Strongs Creek, Utah.

Elevation (m)	1539	1630	1737
Fish one	20.57	22.72	
Fish two	19.89	17.29	
Fish three	22.07	28.41	32.97
Fish four			
Fish five	25.66	37.78	
Fish six		33.72	43.71
Average (Standard Deviation)	22.05 (2.57)	27.98 (8.24)	38.34 (7.59)

Discussion

Our study showed that the rainbow trout within Strongs Creek are relatively short lived, with an average age of 3 years old in the fish we sampled. We did not capture any age 0 fish, likely due to a bias in sampling gear used with regards to dipnet mesh size. We found the age structure of the rainbow trout within Strongs Creek to be comparable to that of redband trout (a subspecies of rainbow trout) sampled from multiple creeks within Idaho with similar widths and depths to that of Strongs Creek (Allen et al. 1995). The authors found that redband trout lived to be 4 years old within these creeks, with an average age of 2 years old in the fish they sampled. The slight differences in our findings compared to Allen et al. (1995) could be due to the relatively small sample size in our study.

The rapid first-year growth of rainbow trout within Strongs Creek is also consistent with findings from that of Allen et al. (1995). Redband trout had an average first-year growth of 84 mm within multiple Idaho creeks that they sampled. It is believed that rainbow trout allocate large amounts of their energy in their first year to somatic growth in order to reduce predation pressures on them (Biro et al. 2005). Our findings within Strongs Creek support this notion as well. After this rapid first-year of growth, rainbow trout within Strongs Creek did not grow nearly as fast, most likely allocating more energy towards reproduction and survival than growth. Even though growth slowed following the first year, we observed that it remained fairly consistent in fish sampled throughout the remainder of their lives, as illustrated in the similar standard deviations between second and third year growth within the same sites. This consistent growth in rainbow trout throughout their lifespan was also found by Hining et al. (2000) in a small Appalachian stream, and appears to be a trend among rainbow trout in small stream settings. This is most likely due to relatively stable environments small streams provide with regards to temperature, flow, and resource availability.

Overall, growth and age of rainbow trout within Strongs Creek appear to be fairly similar to rainbow trout from other studies. Future studies of rainbow trout in streams along the Wasatch Front are recommended to compare our findings of growth and age to other rainbow trout populations in mountainous creeks. With more data available from these small stream settings we can compare different habitats to determine whether changes in flow, temperature, and resource availability in streams has an effect on the growth and age of rainbow trout.

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